

## Spin-Dependent Resonant Intraband and Interband Tunneling

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Recent theoretical studies suggest the possibility of polarizing electron spins by resonant tunneling [1], and obtaining spin-polarized current in resonant tunneling heterostructures at zero magnetic field [2]. A typical resonant tunneling spin-filtering device structure consists of double barriers surrounding an asymmetric quantum well, where quantized states are spin-split by the Rashba effect. In this work we report our theoretical analysis of spin polarization effects in InAs/GaSb/AlSb resonant tunneling structures. Heterostructures of InAs/GaSb/AlSb are strong candidates for pronounced Rashba spin splitting because of the large spin-orbit interaction in InAs and GaSb, the availability of both InAs and GaSb for the construction of highly asymmetric quantum wells, and the presence of a variety (type-I, type-II staggered, and type-II broken-gap) of interface types. The presence of the type-II broken-gap band offset also allows us to fabricate resonant interband tunnel (RIT) structures, where the quasibound states have opposite  $k$ -parallel dispersions to those in the electrodes. Our calculations show that it is possible to obtain rather large Rashba spin splitting in asymmetric AlSb/InAs/GaSb tunnel structures in the absence of applied bias, and that the splitting may be increased or decreased by biasing. We will report the difference between spin-dependent tunneling properties between intraband and interband resonant tunneling structures.

[1] E. A. de Andrada e Silva and G. C. La Rocca, Phys. Rev. B 59, 15583 (1999).

[2] A. Voskoboynikov, S. S. Lin, C. P. Lee, and O. Tretyak, J. Appl. Phys. 87, 387 (2000).